to the northward of this brighter portion there was no diffused light, whereas diffused light extended 10° to 8° along its southern outline. Hence the southerly displacement of the central axis.

Jnly 4th—Lat. 33½° N.; Long. 147° W. Moon's age, 7 days.

Misty night, with frequent breaks of intensely clear sky. Could distinguish twelve stars in the *Pleiades* with the naked eye. (o *Ceti* appears to be as bright as γ *Ceti.*) Galaxy = intensity 9 in *Scorpio*, fading to 0 in *Perseus* and *Taurus*. Zodiacal Light just discernible from 2:00 A. M. At 3:00 A. M. the Light = intensity 6 in *Aries* and *Pisces*. Light extended from *Pleiades* (cloudy below this point) to a few degrees beyond δ *Piscium*, the southern outline being best defined. Very hard to distinguish northern outline N. of *Pleiades* from twilight. No trace of Light in *Aquarius*.

A glow, roughly contained between *t*, *v*, λ, ζ *Sagittarii*, may be the Gegenschein or may be due to the Galaxy.

R. M. S. "WARRIMOO," July 6, 1900.

PLANETARY PHENOMENA FOR SEPTEMBER, OCTOBER, NOVEMBER, AND DECEMBER, 1900.

BY MALCOLM MCNEILL.

SEPTEMBER.

The Sun reaches the autumnal equinox September 23d, 4 A. M., P. S. T.

Mercury rises about an hour before the Sun on September 1st, but rapidly approaches superior conjunction, reaching it on September 13th, and becoming an evening star, but does not get far enough away for visibility during the rest of the month.

Venus is a morning star, and rises about three and one half hours before sunrise. It reaches its greatest western elongation, 46°, on the night of September 16-17th. It moves about 30° eastward and 4° southward from *Gemini*, south of *Castor and Pollux*, through *Cancer* into *Leo*, and at the end of the month is about 6° west and north of *Regulus*.

Mars rises before 1 A.M. It moves about 18° eastward and 3° southward from *Gemini* into *Cancer*. During the early part

of the month it is in the neighborhood of *Castor and Pollux*, and on September 6th passes 6° south of *Pollux*. It is beginning to draw nearer the Earth, and while still not very conspicuous, it is nearly twice as bright as it was during conjunction in January.

Jupiter is drawing rather close to the Sun, and by the end of the month sets less than three hours after sunset. It is still in the constellation *Scorpio*, and moves about 4° eastward during the month.

Saturn is also in the western sky in the evening, somewhat higher up than *Jupiter*, and remains above the horizon until about 10 P. M. on September 30th. It ceases its westward motion and resumes its eastward motion on September 2d, and by the end of the month it has moved rather less than 1° along a line a little south of the course it pursued while moving westward.

Uranus moves a little less than 1° eastward in the constellation *Scorpio*, not far away from *Jupiter*. *Jupiter's* greater relative motion eastward is bringing the two planets nearer together, and at the end of the month *Uranus* is 2° east and 1° south of *Jupiter*. The planets are, however, so low down after sunset when the stars come out that it will not be an easy matter to see *Uranus* without a telescope.

Neptune is in about the same place on the dividing-line between *Taurus* and *Gemini*.

October.

Mercury is an evening star throughout the month, coming to greatest east elongation on October 29th; but on account of the great southern declination of the planet, it remains above the horizon too brief a time after sunset to be visible, except possibly during the last few days of the month when the interval is about an hour.

Venus is a morning star, rising about three and one half hours before sunrise. It has begun to approach the Sun and the distance lessens about 4° during the month. Its motion among the stars is 32° eastward and 11° southward through *Leo* into *Virgo*. On October 7th it passes less than 1° south of *Regulus*, *α Leonis*.

Mars rises before midnight at the end of the month. It moves 17° eastward and 4° southward from *Cancer* into *Leo*, passing very close to the "Beehive" cluster in the former constellation during the first week of the month.

Jupiter is drawing too close to the Sun for the best observation, and by the end of the month sets less than two hours later. It moves about 6° eastward and southward during the month in *Scorpio.* There will be a very close conjunction with the Moon on the evening of October 26th, which will be an occultation west and south of the United States.

Saturn is in the southwestern sky in the evening, following about an hour after *Jupiter.* It is still in *Sagittarius*, north of the principal stars, and moves 2° eastward during the month.

Uranus is too low down after sunset for good observation. It is very near *Jupiter*, and the two planets are in conjunction on October 19th, *Jupiter* being 25′ north of *Uranus.* On October 26th *Uranus* is occulted by the Moon, the phenomenon taking place shortly after sunset in the eastern part of the United States.

Neptune is nearly stationary.

NOVEMBER.

Eclipse.—There will be an annular eclipse of the Sun on the morning of November 22d, visible only in the southern hemisphere. The path of the annulus begins in the South Atlantic, crosses South Africa and the Indian Ocean, and ends in Australia.

Mercury is an evening star at the beginning of the month, setting a little less than an hour after sunset, then rapidly approaches the Sun, passing inferior conjunction on November 20th, and becoming a morning star. By the end of the month it rises an hour and a half before sunrise, and will be an easy object to see in good weather.

Venus is a morning star, and is drawing nearer the Sun. The interval between its rising and sunrise shortens to about three hours at the end of the month from half an hour greater at the beginning. It moves 33° eastward and 13° southward from one end to the other of *Virgo.* On November 6th it passes 13′ north of the fourth-magnitude star *η Virginis.*

Mars rises earlier, at about 11 P.M., at the close of the month. It moves 13° eastward and 4° southward through the western part of *Leo*, and on November 18th passes about 1° 30′ north of *Regulus, α Leonis.*

Jupiter is drawing too close to the Sun to be conspicuously seen during the latter half of the month, the interval between sunset and its setting being less than an hour at the end. Still it is so bright that it can be seen if one looks sharply.

Saturn is also drawing nearer the Sun, and by the end of the month sets less than two hours after sunset. It moves 3° eastward in the constellation *Sagittarius* a little north of the handle of the "dipper."

Uranus is also in the neighborhood of the Sun, not quite as far to the east as *Jupiter*, and too near to be seen, on account of its faintness.

Neptune is retrograding (moving westward) slowly in the extreme eastern part of *Taurus*.

DECEMBER.

The Sun reaches the solstice, and winter begins December 21st, 10 P.M., P. S. T.

Mercury is a morning star throughout the month, and comes to greatest west elongation on the evening of December 7th. It then rises about an hour and three quarters before sunrise, and until nearly the close of the month the interval is more than an hour. So this is one of the best times of the year for seeing the planet if one is an early riser.

Venus is still a morning star, slowly overtaking the Sun on its eastward journey. The interval between the rising of the planet and the Sun shortens from three to a little more than two hours during the month. The planet moves 38° eastward and 10° southward from the eastern part of *Virgo* through *Libra* into *Scorpio*.

Mars is getting into position for evening observation, rising before 10 P. M. at the end of the month. It is still moving eastward among the stars in *Leo*, and traverses an arc of 8°, but the motion is slowing up, preparatory to the retrograde motion about the time of opposition in 1901. On December 16th it passes only 6′ south of the fifth magnitude star ι *Leonis*. Its actual distance from the Earth is diminishing, and on December 24th it is the same as the Earth's mean distance from the Sun. Its brightness has also increased, and at the end of December it is about six times as great as it was at the time of conjunction with the Sun in January. It will be much brighter than this at opposition, but is now beginning to be a noteworthy object.

The next three planets all come to conjunction with the Sun during December — *Jupiter* on the 14th, *Saturn* on the 29th, and *Uranus* on the 5th. Consequently, none of them are in good position for observation, and they will not be far enough

away to be conspicuously seen as morning objects until February or March, 1901. There will be an interesting conjunction of *Mercury* and *Jupiter* on the morning of December 30th, *Mercury* being 44′ south of *Jupiter*. The latter can probably be seen in the morning twilight, but it is doubtful whether the former can be seen without a telescope.

Neptune is in opposition with the Sun on December 19th.

September–October, 1900.

Phases of the Moon, P. S. T.

First Quarter . . .	Sept.	1,	11^h 56^m	P. M.
Full Moon	Sept.	8,	9 6	P. M.
Last Quarter . . .	Sept.	15,	12 57	P. M.
New Moon	Sept.	23,	11 57	A. M.
First Quarter . . .	Oct.	1,	1 11	P. M.
Full Moon	Oct.	8,	5 18	A. M.
Last Quarter . . .	Oct.	15,	1 51	A. M.
New Moon	Oct.	23,	5 27	A. M.
First Quarter . . .	Oct.	31,	12 17	A. M.

The Sun.

1900.	R. A.	Declination.	Rises.	Transits.	Sets.
Sept. 1,	10^h 41^m	+ 8° 22′	5^h 31^m A.M.	noon	6^h 29^m P.M.
11,	11 17	+ 4 39	5 42	11 57 A.M.	6 12
21,	11 53	+ 0 47	5 51	11 53	5 55
Oct. 1,	12 29	− 3 7	6 0	11 50	5 40
11,	13 5	− 6 57	6 11	11 47	5 23
21,	13 43	− 10 38	6 21	11 45	5 9
31,	14 21	− 14 3	6 32	11 44	4 56

Mercury.

Sept. 1,	9 59	+ 13 56	4 31 A.M.	11 19 A.M.	6 7 P.M.
11,	11 12	+ 6 59	5 28	11 52	6 16
21,	12 18	− 0 53	6 21	12 18 P.M.	6 15
Oct. 1,	13 17	− 8 20	7 6	12 38	6 10
11,	14 13	− 14 49	7 46	12 55	6 4
21,	15 7	− 19 58	8 20	1 9	5 58
31,	15 54	− 23 13	8 40	1 16	5 52

Venus.

Sept. 1,	7 39	+ 17 40	1 58 A.M.	8 59 A.M.	4 0 P.M.
11,	8 16	+ 16 59	1 57	8 56	3 55
21,	8 56	+ 15 33	2 2	8 56	3 50
Oct. 1,	9 38	+ 13 20	2 13	8 59	3 45
11,	10 21	+ 10 23	2 26	9 2	3 38
21,	11 4	+ 6 50	2 43	9 6	3 29
31,	11 47	+ 2 48	3 1	9 10	3 19

MARS.

Sept.	1,	7	3	+	23	15	1	0 A.M.	8	23 A.M.	3	48 P.M.
	11,	7	30	+	22	35	12	49	8	10	3	31
	21,	7	56	+	21	41	12	40	7	57	3	14
Oct.	1,	8	21	+	20	35	12	30	7	43	2	56
	11,	8	45	+	19	20	12	19	7	27	2	35
	21,	9	8	+	17	59	12	7	7	10	2	13
	31,	9	29	+	16	35	11	54 P.M.	6	52	1	50

JUPITER.

Sept.	1,	16	3	—	20	10	12	34 P.M	5	22 P.M.	10	10 P.M.
Oct.	1,	16	20	—	20	58	10	55 A.M.	3	40	8	25
Nov.	1,	16	44	—	21	54	9	22	2	3	6	44

SATURN.

Sept.	1,	17	53	—	22	36	2	32 P.M.	7	11 P.M.	11	50 P.M.
Oct.	1,	17	56	—	22	41	12	38	5	16	9	54
Nov.	1,	18	5	—	22	45	10	45 A.M.	3	23	8	1

URANUS.

Sept.	1,	16	27	—	21	43	1	4 P.M.	5	46 P.M.	10	28 P.M.
Oct.	1,	16	30	—	21	50	11	9 A.M.	3	51	8	33
Nov.	1,	16	37	—	22	3	9	14	1	55	6	36

NEPTUNE.

1900.		R. A.	Declination.	Rises.	Transits.	Sets.
Sept.	1,	$5^h\,56^m$	+ 22° 14′	$11^h\,55^m$ P.M.	$7^h\,15^m$ A.M.	$2^h\,35^m$ P.M.
Oct.	1,	5 57	+ 22 13	9 59	5 19	12 39
Nov.	1,	5 56	+ 22 12	7 56	3 16	10 36 A.M.

ECLIPSES OF *JUPITER'S* SATELLITES, P. S. T.

(Off right-hand limb as seen in an inverting telescope.)

I, R,	Sept.	1,	$10^h\,19^m$ P.M.	I, R,	Oct.	3,	$6^h\,34^m$ P.M.
I, R,		3,	4 46	I, R,		19,	5 12
II, D,		3,	4 52	I, R,		26,	7 7
II, R,		3,	7 21	II, R,		30,	4 21
I, R,		10,	6 41				
II, D,		10,	7 30				
II, R,		10,	10 0				
I, R,		17,	8 35				
III, R,		23,	4 50				
I, R,		26,	5 0				
II, R,		28,	4 34				
III, D,		30,	6 44				

NOVEMBER–DECEMBER, 1900.

PHASES OF THE MOON, P. S. T.

Full Moon	Nov. 6,	3h 0m	P. M.
Last Quarter . . .	Nov. 13,	6 37	P. M.
New Moon . . .	Nov. 21,	11 17	P. M.
First Quarter . . .	Nov. 29,	9 35	A. M.
Full Moon	Dec. 6,	2 38	A. M.
Last Quarter . . .	Dec. 13,	2 42	P. M.
New Moon	Dec. 21,	4 1	P. M.
First Quarter . . .	Dec. 28,	5 48	P. M.

THE SUN.

1900.	R. A.	Declination.	Rises.	Transits.	Sets.
Nov. 1,	14h 25m	− 14° 23′	6h 34m A.M.	11h 44m A.M.	4h 54m P.M.
11,	15 5	− 17 23	6 45	11 44	4 43
21,	15 46	− 19 53	6 57	11 46	4 35
Dec. 1,	16 29	− 21 47	7 5	11 49	4 29
11,	17 12	− 23 0	7 16	11 53	4 30
21,	17 57	− 23 27	7 23	11 58	4 33
31,	18 41	− 23 7	7 26	12 3	4 40

MERCURY.

Nov. 1,	15 57	− 23 24	8 41 A.M.	1 16 P.M.	5 51 P.M.
11,	16 15	− 23 21	8 18	12 54	5 29
21,	15 37	− 18 29	6 42	11 37 A.M.	4 32
Dec. 1,	15 14	− 15 18	5 28	10 35	3 42
11,	15 47	− 17 56	5 31	10 28	3 25
21,	16 43	− 21 33	6 1	10 44	3 27
31,	17 47	− 23 55	6 37	11 00	3 41

VENUS.

Nov. 1,	11 52	+ 2 22	3 3 A.M.	9 11 A.M.	3 19 P.M.
11,	12 36	− 1 59	3 22	9 15	3 8
21,	13 21	− 6 25	3 42	9 20	2 58
Dec. 1,	14 6	− 10 43	4 4	9 27	2 50
11,	14 54	− 14 41	4 26	9 35	2 44
21,	15 43	− 18 5	4 48	9 45	2 42
31,	16 35	− 20 42	5 11	9 57	2 43

MARS.

Nov. 1,	9 31	+ 16 26	11 53 P.M.	6 50 A.M.	1 47 P.M.
11,	9 50	+ 15 2	11 38	6 30	1 22
21,	10 8	+ 13 41	11 22	6 9	12 56
Dec. 1,	10 24	+ 12 28	11 2	5 45	12 28
11,	10 38	+ 11 25	10 41	5 20	11 59 A.M.
21,	10 49	+ 10 38	10 16	4 52	11 28
21,	10 57	+ 10 11	9 45	4 20	10 55

Jupiter.

Nov.	1,	16	44	— 21	54	9	22 A.M.	2	3 P.M.	6	44	P.M.
Dec.	1,	17	12	— 22	39	7	54	12	33	5	12	
Jan.	1,	17	43	— 23	5	6	24	11	1 A.M.	3	38	

Saturn.

Nov.	1,	18	5	— 22	45	10	45 A.M.	3	23 P.M.	8	1	P.M.
Dec.	1,	18	18	— 22	45	9	0	1	38	6	16	
Jan.	1,	18	34	— 22	37	7	14	11	52 A.M.	4	30	

Uranus.

Nov.	1,	16	37	— 22	3	9	14 A.M.	1	55 P.M.	6	36	P.M.
Dec.	1,	16	44	— 22	17	7	24	12	4	4	44	
Jan.	1,	16	52	— 22	31	5	32	10	11 A.M.	2	50	

Neptune.

Nov.	1,	5	56	+ 22	12	7	56 P.M.	3	16 A.M.	10	36	A.M.
Dec.	1,	5	53	+ 22	11	5	51	1	11	8	31	
Jan.	1,	5	49	+ 22	11	3	46	11	6 P.M.	6	26	

ECLIPSES OF *JUPITER'S* SATELLITES, P. S. T.

(Off right-hand limb as seen in an inverting telescope.)

I, R,	Nov.	4,	$3^h\ 30^m$ P.M.	III, R,	Nov.	5,	$4^h\ 51^m$ P.M.
III, D,		5,	2 38 P.M.	I, R,		11,	5 25 P.M.

No eclipses visible this year after November 11th, *Jupiter* being too near the Sun.